Motiv Emot (2013) 37:776–786
DOI 10.1007/s11031-013-9342-9

ORIGINAL PAPER

Duchenne display responses towards sixteen enjoyable emotions: Individual differences between no and fear of being laughed at

Tracey Platt · Jennifer Hofmann · Willibald Ruch · René T. Proyer

Published online: 7 February 2013

Abstract The present study aims to identify whether individuals' with a fear of being laughed at (gelotophobia), respond with less facially displayed joy (Duchenne display) generally towards enjoyable emotions or only those eliciting laughter. Forty participants (no vs. gelotophobia) described their feelings to scenarios prototypical for the 16 enjoyable emotions proposed by Ekman (Emotions revealed: recognizing faces and feelings to improve communication and emotional life. Times Books, New York, 2003), while being unobtrusively filmed. Facial responses were coded using the Facial Action Coding System (FACS, Ekman et al. in Facial Action Coding System: a technique for the measurement of facial movement. Consulting Psychologists Press, Palo Alto, 2002). The gelotophobes showed less facial expression of joy compared to the non-gelotophobes (Hypothesis 1) and this effect was stronger for frequency and intensity of Duchenne displays towards laughter-eliciting enjoyable emotions than for no laughter-eliciting enjoyable emotions (Hypothesis 2). Moreover, the no gelotophobia group responded more strongly to laughter-eliciting than to no laughter-eliciting enjoyable emotions. Individuals with marked gelotophobia showed the reverse pattern, displaying less joy in laughter-eliciting emotions which may impact on their social interaction, as communication may break down when positive emotion are not reciprocated.

Keywords Fear of being laughed at (gelotophobia) · Enjoyable emotions · FACS · Duchenne display · Joy

T. Platt (✉) · J. Hofmann · W. Ruch · R. T. Proyer
Section on Personality and Assessment, Department of Psychology, University of Zurich, Binzmuehlestrasse 14, Box 7, 8050 Zurich, Switzerland
e-mail: tracey.platt@psychologie.uzh.ch

Introduction

Positive emotions

In early classifications of emotions often one positive emotion, namely, happiness or joy was distinguishable from several negative ones, such as anger, fear, disgust or sadness (e.g., Ekman 1972; Izard 1971). Further investigations showed that the emotion of joy is accompanied by a facial configuration called the *Duchenne display* (Ekman et al. 1990). The Duchenne display refers to the joint and symmetric contraction of the zygomatic major and orbicularis oculi muscles (pulling the lip corners back- and upwards and raising the cheeks and compression of the eyelids causing eye wrinkles, respectively).

Different approaches postulated the existence of multiple enjoyable emotions, rather than the global positive emotion of joy (e.g., Fredrickson 1998; Haidt 2003; Lazarus 1991; Panksepp 1998; Shiota et al. 2004, 2006). However, what constitutes these classifications of positive emotions differs substantially. For example, Fredrickson (1998), Fredrickson and Branigan (2001) separated the positive emotions of joy, contentment, interest, and love, whereas Shiota et al. (2006) distinguished among seven positive emotions, namely joy, contentment, pride, love, compassion, amusement and awe. Furthermore, de Rivera et al. (1989) were able to discriminate between the three positive emotions elation, gladness and joy based on their propensity of participants being able to recall unique experiences for them. Finally, Mortillaro et al. (2011) explored differences in facial expressions between the four enjoyable emotions of interest, pride, pleasure, and joy.

Ekman (1994, 2003) identified 16 universal enjoyable emotions that involve different states of mind. Although he does not claim that the list is fully representative, he does

distinguish among five sensory pleasures (i.e., tactile, olfactory, auditory, visual and gustatory), amusement, contentment, excitement, relief, wonder, ecstasy (self-transcendent rapture), *fiero* (pride in ones own achievements), *naches* (pride in the achievements of others, with whom you have a relationship), elevation, gratitude and *schadenfreude* (the joy of a rivals misfortune), giving anecdotal evidence for each of these proposed enjoyable emotions. He states that defining the emotions will be achieved by "research, which examines when they occur, how they are signaled and what occurs internally can answer those questions" (2003, p. 226). Speculating that although positive emotion has so far had only one facial display recognized (i.e., the enjoyment smile or Duchenne display) the 16 enjoyable emotions could differ in their parameters—i.e., onset/offset, duration of apex and/or emotion event and intensity. However, so far, no systematic investigation of the typical intensity of these 16 different enjoyable emotions has been undertaken, therefore the extent of agreement between experience and expression is not known. A divergence might be likely, for example, individuals might feel deep contentment but smile only at low intensity. As there is yet no widely agreed upon classification of positive emotions, any decision based on theoretical reasoning for any of the suggested classifications has strengths and weaknesses. To cover the broadest possible spectrum of positive emotions offered by one approach we decided to examine the list proposed by Ekman (2003).

Gelotophobia: The fear of being laughed at

Gelotophobia (i.e., the fear of being laughed at) has recently been introduced as an (inter-) individual difference variable that is not only relevant in clinical practice but also as part of a normal variant of personality (Ruch and Proyer 2008a, b; Titze 2009). Ridicule induces shame in the target, which is emotionally painful. Hence some individuals may develop a habitual fear of being laughed at, especially if they are highly sensitive or were exposed to repeated traumatic experiences of being laughed at. The observation that the fear of being laughed at is also prevalent among healthy adults led to the postulate of a non-pathological dimension ranging from no fear to extreme fear (Ruch and Proyer 2008b).

Gelotophobia and low propensity for joy

Despite the fact that shame and fear are the most salient emotions relating to gelotophobia, the low propensity of joy is equally relevant. It was observed in a clinical setting that gelotophobic patients lack liveliness, spontaneity and joy and frequently appear distant and cold (Titze 2009). While Titze places low joy as a consequence of the fear of being laughed at modeled into the putative causes and consequences (Ruch 2004), the propensity to low joy might also be seen a moderator in the development of shame anxiety (Ruch and Proyer 2008a). A consequence relating to low joy is that humor and laughter are not seen as relaxing and joyful social experiences but seen as weapons to put them down.

Discordance to joyful experience relating to laughter and laughter related situations has empirical evidence from a number of different sources (Platt 2008; Platt and Ruch 2009; Ruch et al. 2009). In self-report studies of basic emotions anchored to the maximal intensity of that emotion ever, Platt and Ruch (2009) showed for German and English adults, those higher in gelotophobia reported their most joyful experience in their lives were of a lower intensity than the ones for non-gelotophobes compared to the maximum attainable. Their most intense experience of joy had higher latency (i.e., took the emotion longer to begin) and lasted for a much shorter duration. Gelotophobes in the German-speaking sample also reported the joy to be less facially expressed. Furthermore, Ruch et al. (2009) found that gelotophobes compared to non-gelotophobes scored lower in trait cheerfulness in three samples, and Proyer et al. (2012) found gelotophobes to be generally lower in life satisfaction in three countries.

More intriguing is the first evidence that gelotophobes do not perceive the positive affect in laughter. Ruch et al. (2009) showed that those with a fear of being laughed at perceived positively motivated laughter (e.g., hearty, friendly) as less pleasant compared to the non-gelotophobic group. They also stipulated more often that the laughing person was in a negative motivational state (e.g., angry, malicious) when laughing than the non-gelotophobes did, who actually attributed benevolent states more often.

Joy may not be contagious for gelotophobes. Ruch et al. (2009) showed that for those with no or a borderline fear of being laughed at, the level of positive mood increased from before to after hearing a CD of different laughter, while the scores for the gelotophobes did not change (but dropped numerically). Likewise, when being exposed to emotionally contagious films, gelotophobes showed higher degrees of emotional contagion than non-gelotophobes to films of negative quality (e.g., sadness, anxiety, anger) but not to cheerful or joyful films (Papousek et al. 2009). Thus, gelotophobes do not seem to benefit from joy eliciting stimuli and this should also be evident in the facial expressions of gelotophobes.

All in all, these studies express a link between gelotophobia and a person's hedonic capacity. Meehl (1975) stated that a person's hedonic capacity, namely, the individual's ability to experience pleasurable affect differs greatly among individuals distributed in a normal

population. However, if (inter-) individual differences do exist, logically, gelotophobes should only experience lowered hedonic capacity to joy when it is linked to laughter. However, the studies conducted so far were restricted to the verbal domain without any indication that gelotophobes actually express joy in a lower intensity in behavior. Furthermore, for all sixteen enjoyable emotions it is unclear whether there is low joy experienced to all or only when the emotion generates laughter, if indeed certain enjoyable emotions are linked to laughter.

Applying the 16 enjoyable emotions proposed by Ekman (2003) will allow the investigation of the differences between gelotophobes and non-gelotophobes towards a higher number of enjoyable emotions and it will also allow the examination of whether some of these enjoyable emotions go along with laughter, and if specifically it is these enjoyable emotions that are averse to gelotophobes. As Ekman et al. (2005) demonstrated, it is possible to utilize such facial expressions for understanding affective disorders. The discernable Duchenne display associated with felt emotion will occur in all enjoyable emotions and differences among groups of gelotophobes and non-gelotophobes can be investigated.

Laughter-eliciting and enjoyable emotions and gelotophobia

Ekman (2003) suggests that joy can be shown silently or audibly and he lists various vocalizations presumably accompanying pleasurable emotions, with laughter being a salient one. However, the expression of joy (or happiness) "can vary from a smile to a broad grin and, at some stage along the line, there can be chuckling as well, or laughter, in the most extreme form, laughter with tears" (Ekman and Friesen 2003, p. 101). He goes on to assert that the presence of laughing or chuckling does not indicate the intensity of joy, as one can be extremely happy without laughing. Rather, laughing and chuckling occur with particular types of joy experiences; e.g., ones relating to play (if sufficiently exciting) and humor. Research has shown that the laughter vocalizations typically are embedded in a Duchenne display event (Keltner and Bonnano 1997; Ruch 1993; Ruch and Ekman 2001). Although non-Duchenne laughter exists as well, joyful laughter is based on the Duchenne display, and the intensity of the enjoyment is best reflected in the intensity of the Duchenne display. This relation to facial expression can be utilized in the current study as an objective measure of responses towards the 16 enjoyable emotions.

It has been claimed that for gelotophobes humor and laughter are not relaxing and joyful experiences (Ruch and Proyer 2008a). As humor elicits amusement, gelotophobes might be even less prone to show facial enjoyment during amusement. With regards to laughter in enjoyable emotions Ekman (2003) mentions its occurrence only in the context of amusement. However, laughter has been mentioned to occur in other enjoyable emotions, such as *schadenfreude* and relief, and it might occur in some others, but definitely not all of the 16 enjoyable emotions. Contentment or gratitude will not elicit laughter, for example (Ekman 2003). Ruch et al. (2009) used laughter of different positive qualities and gelotophobes failed to perceive their positive quality and to rate them as pleasant. So, if laughter is elicited by any enjoyable emotion other than amusement, we can expect that it is these emotions, which are less enjoyed by gelotophobes and subsequently, the ones that elicit no or less Duchenne display responses.

Aim of present study

Based on this literature review, and Ekman's (2003) speculation that the 16 enjoyable emotions may produce differences in intensities of facial behavior from weak Duchenne smiles to strong laughter, two main hypotheses will be investigated.

H1 The previously found gelotophobes' lower propensity to joy also extends to their facial behavior; i.e., they actually show less facial expression of joy compared to the non-gelotophobes in response to 16 enjoyable emotions. This will be primarily tested as a main effect but additionally examined for different levels of aggregation, namely the individual enjoyable emotions, and the groups of laughter and no laughter inducing enjoyable emotions.

H2 Gelotophobes and non-gelotophobes will differ more strongly in their facial displays for the laughter-eliciting enjoyable emotions than for the no laughter-eliciting enjoyable emotions. This will be tested by first examining the interaction, and then seeing whether the no gelotophobia group responds more strongly to laughter-eliciting enjoyable emotions than to no laughter-eliciting enjoyable emotions while the reverse is the case for the gelotophobia group.

Method

Participants

The total sample consisted of 40 German-speaking volunteers (25 females, 15 males; age $M = 50.40$, $SD = 11.8$ years). The *gelotophobia* group was formed by 20 adult volunteers (8 males; age range from 19 to 78 years, $Mdn = 33.00$ years) that exceeded the cut-off value for gelotophobia in an online screening (that led to invitations to an experiment) as well as before the experiment. The double

check helped to make sure that the participants had at least a slight fear of being laughed at. Of the 20, 8 could be classified as slight (i.e., between 2.5 and 3.0), 9 as marked (3.0–3.5), and 3 as extremely (>3.5) fearful of being laughed at. None of them were enrolled in therapeutic treatment or consumed psychotropic medication at the time the experiment took place. The control group (or *no gelotophobia* group) was formed of 20 participants that reported to have no fear of being laughed at (7 males; age range from 22 to 71 years, $Mdn = 48.50$ years). Their gelotophobia scores ranged from 1.07 to 1.88 ($M = 1.52$, $SD = 0.24$) and were significantly lower than the one of the gelotophobia group during the second testing ($M = 3.03$, $SD = 0.36$), $F\ (1,\ 39) = 234.160$, $p < .001$, $d = 4.94$.

An online pre-screening yielded a total of 70 gelotophobes that were subsequently invited to the lab to undertake further studies and 23 of those accepted to participate. Although this may seem a low acceptance rate, it is in accordance that within the Swiss population, gelotophobes make up only around 5 % approximately (Samson et al. 2011). The other group was made up of 20 participants with no fear of being laughed at participated. Of this sample two were excluded from the study due to instability of their score on the GELOPH<15> (Ruch and Proyer 2008b), which on second testing brought them below the cut-off point and one was excluded due to the poor film quality of the head and shoulder movements.

Instruments

The *PhoPhiKat-45* (Ruch and Proyer 2009) is a 45 item self-report questionnaire utilizing a four-point answering format (1 = *strongly disagree* to 4 = *strongly agree*) for the assessment of gelotoph*o*bia ("When they laugh in my presence I get suspicious"), gelotoph*i*lia ("When I am with other people, I enjoy making jokes at my own expense to make the others laugh") and *kat*agelasticism ("I enjoy exposing others and I am happy when they get laughed at"). All scales possess satisfactory internal consistencies, Cronbach alpha ranging from $\alpha = .79$ for katagelasticism to $\alpha = .82$ for gelotophilia and gelotophobia (Ruch and Proyer 2009). Test–retest correlations were between .80 and .86 for a 3 and 6 months interval, respectively. Only the gelotophobia (PHO) subscale was used in this study.

The standard state form of *State-Trait Cheerfulness Inventory* (STCI-S<30>, Ruch et al. 1997) used 30 items to be rated on a four-point answer format (1 = *strongly disagree* to 4 = *strongly agree*) to assess the current states of cheerfulness, seriousness and bad mood. Ruch and Köhler (2007) report high internal consistencies, but low 1-month test–retest stability (between .33 and .36), confirming the nature of transient states.

The *Positive and Negative Affect Schedule-State Measure, German version* (PANAS-S, Krohne et al. 1996) is a 20 item index with ten positive affect items, such as interested, proud and strong, and ten negative affect items, such as distressed, afraid and jittery. Participants rate the intensity of their affective states on a 5-point (1 = *very slightly* to 5 = *very much*) scale. The instructions for this scale can be varied in regard to the temporal set. The state-oriented wordings were employed in this study.

The *16 Pleasurable Emotions Interview Task- German language version* (16-PEIT, Platt et al. 2011) is a standardized interview aimed at assessing the individual's propensity towards the 16 enjoyable emotions proposed by Ekman (2003). The 16-PEIT consists of 39 scenarios pretested to verify that they prototypically elicit sensory pleasures (visual, tactile, olfactory, auditory, gustatory), amusement, contentment, excitement, relief, wonder, ecstasy, *fiero, naches*, elevation, gratitude, and *schadenfreude* (one example scenario for each facet of pleasurable emotion is given in Table 1).

The scenarios were based on 90 examples obtained in a scenario generation online study which were further reduced when screened to meet the criteria of being highly prototypical examples with no or only minor emotion blends, subsequently the number of scenarios do differ for each of the emotion by two independent raters familiar with the Ekman (2003) definitions of the pleasurable emotions, who went through each item and judged whether it fit into one and only one of the 16 enjoyable emotions. This process reduced the number of items to 64. Finally, 240 adults (82 males) in the ages between 18 and 71 years ($M = 32.87$, $SD = 15.09$) verified whether each of the 64 items fits (*yes*, *marginally* or *no*) to the descriptions of 16 enjoyable emotions. Furthermore, the participants were also asked to rate each of the 64 items for the expected likelihood of occurrence of joy and laughter on a rating scale (1 = *not at all* to 5 = *very much*). Among the non-gelotophobes, the scores for joy ranged from 2.51 (for *schadenfreude*) to 4.29 (for *naches*), and for laughter, the scores ranged from 2.41 (for elevation) to 3.62 (for wonder). Overall, items eliciting lower levels of joy or not being prototypical were excluded and the final list of 39 items of the 16-PEIT was created. They were brought in random order, which was used in the presentation.

The participants were informed that the aim of the interview is to find out what kinds of feelings are elicited by different scenarios. They were instructed that after being orally presented a scenario they should imagine they were the protagonists in each scenario and elaborate the emotions they imagined to experience in the given scenario. Interviewers were trained beforehand to have their behavior standardized as much as possible and feedback from tapes were given from trials runs. They were instructed

Table 1 Example scenarios for each of the 16 enjoyable emotions

Enjoyable emotion	Sample scenario
Visual	Imagine you were sitting on a hill and you would watch a beautiful sunset
Tactile	Imagine you were sitting in a meadow and the grass is tickling your skin
Olfactory	Imagine walking into a kitchen where you can smell your favorite food being cooked
Auditory	Imagine being at a concert where you hear your favorite band giving their best performance
Gustatory	Imagine slowly melting a piece of your favorite confectionary on your tongue and savoring the flavors
Amusement	Imagine inventing a very funny joke or wordplay just by yourself
Contentment	Imagine deeply loving someone and being loved back in return
Excitement	Imagine that you are preparing a very special surprise for your best friend
Relief	Imagine losing your caretaker in a huge supermarket and after a long time of searching you are returned to them
Wonder	Imagine you travelled to the other side of the planet and bumped into an old friend, which you had always liked a lot but lost contact with
Ecstasy	Imagine having fantastic sex with ones' partner
Fiero	Imagine that you have mastered something that is very intellectually challenging
Naches	Imagine that you have a child and you are present when they take their first steps
Elevation	Imagine that you see a random stranger doing a good deed by helping a person who is really in need of assistance
Gratitude	Imagine you are sick and in hospital. Some friends take the time to come and visit you out of their busy day
Schadenfreude	Imagine that you are arguing with someone who is being obnoxious. During the argument your opponent's false teeth fall out

how to ask for more detail when necessary and how to get back to the topic if the participant diverged from the topic. The participants were asked for consent for their responses to be audio-taped with the means of later content analysis. This was to disguise that their facial responses were also recorded. The responses typically lasted between 10 s and 3 min. Only the sequences where participants answered in agreement to the instructions were considered relevant for FACS coding. A comprehensive analysis of the 16-PEIT may include content analysis, as well as self-rating of the level of joy experienced and measurement of facial expressions. This study will focus on the facial expressions measurement.

Procedure

Pre-experiment

Four pre-trained interviewers (two of each gender) were used to administer the 16-PEIT. Each was given an identical script for the duration of the experiment, which they had to practice role-playing in pairs to standardize all the questions and interaction with participants.

Main experiment procedure

On the day of filming the interviewers were assigned male and female participants randomly. Before the participants were invited into the recording lab, the interviewer prepared the hidden video camera. Individual participants were then welcomed by their assigned interviewer who explained to them that the study that would consist of three parts in which they would complete questionnaires, followed by an interview where the 39 scenarios of the 16-PEIT would be read out loud to them but where they would be allowed to take time to reflect on, then relate their thoughts and feelings to the different emotions and lastly they would complete a further series of questionnaires before being given a debriefing.

During the procedure precautions were taken by the interviewers to ensure that the responses elicited in participants were directly related to the imagined emotion and not to the social engagement with the interviewer. To begin, the participants completed the PhoPhiKat-45, the state forms of the STCI-S<30> and the PANAS, followed by the 16-PEIT interview task given orally by the interviewer. The average filming session lasted 90 min. During this procedure, a hidden camera videotaped the participant's face. Afterwards, they again filled in the STCI-S<30> and the PANAS-S. At the end of the session, participants were debriefed and informed about the filming and given time to ask questions about the study. During the debriefing the participants were offered to have the video material deleted. No one agreed to the offer. Detailed agreement forms allowing the use of the material to differing degrees was collected, which followed the ethical guidelines set out when granting approval by an ethics committee. No participant was paid for their time but a final general report on the study was offered. The facial responses were analyzed using the Facial Action Coding System (FACS, Ekman et al. 2002).

Filming lab set up

The laboratory room was designed so that a full frontal head and shoulders angle of the participant could be secretly filmed at all time. In order to do this the table and chair was controlled so that no turning could be enabled. The interviewer sat on the diagonal and not in direct view of the participant. A voice-recording instrument was placed in front of the participant and they were asked to speak in the direction of the recorder. This limited them turning to face the interviewer and also allowed them to face directly into the hidden camera, placed inside a book on a bookshelf directly opposite. Although this reduced participant movement and interaction with the interviewer, it was found that when they did turn to face the interviewer it was to engage in conversation, which was subsequently excluded from being coded.

Facial measurement

Measurements were made with a hidden camera, providing full color, digital format films, which gave a close-up, head-on view of the subject's face. The measurements were based on the Facial Action Coding System (FACS, Ekman et al. 2002). The FACS is an anatomically based, comprehensive, objective technique for measuring all observable facial movement. It distinguishes 44 action units (AUs). These are the minimal units that are anatomically separate and visually distinguishable. FACS also allows for measurement of the timing of a facial movement, its symmetry and intensity, and its degree of irregularity of onset, apex or offset.

Two FACS-certified researchers followed an a priori procedure to FACS code only the AUs that occurred as direct responses to the instructions from the interviewer. This produced only one event per scenario that satisfied the set criteria. Typically this was the immediate response after the scenario was read but occasionally this happened after some guiding remarks or explanations. Any further expressions occurring during the verbal response and not directly linked to the task were coded as "chat" and subsequently excluded from further analysis. Decisions on the inclusion of facial responses were made very conservatively. The coding was done using recorded AVI files uploaded to the software Noldus Observer XT.

A random selection of ten of the videos (five for each coder) was double coded and an inter-rater reliability (Kappa = .89) was obtained. The Kappa coefficient was scored as an agreement when both the Action Unit and the AU intensity (FACS conventions of intensity threshold of A to E scored as 1 = trace, 2 = slight, intensity 3 = marked pronounced, 4 = severe extreme, 5 maximum) was correctly scored by both coders. Additionally, two randomly selected videos were coded by a third certified FACS coder for quality control, which had an inter-rater reliability for AU and intensity of Kappa = .84 all of which surpassed the Kappa = .70 advised by Ekman et al. (2002). Following the independent coding, coders met to discuss the deviation in choices of the AUs and AU intensity to reach a final agreement as to which AU and intensity would be used in the study.

Facial variables were formed for responses to every interview scenario separately. Presence of a Duchenne display, its intensity and presence of Duchenne laughter was coded. A *Duchenne display* was defined by the presence of AU12 and AU6 in an event. It may be accompanied by a tightening of the eyelids (AU7) and/or mouth opening (AU25, AU26, AU27) but no other action unit. Intensity of Duchenne display could range from A (trace; coded as 1) to E (maximum; coded as 5) and was coded at the apex. A Duchenne laugh was defined as a Duchenne display additionally accompanied by typical laughter respiration (i.e., initial forced exhalation, followed by a more or less sustained sequence of repeated expirations of high frequency and low amplitude), which may or may not be phonated (e.g., as "ha-ha-ha"). A single forced exhalation (voiced: "ha", or unvoiced: "ch") defined the lower end of the laughter spectrum.

Next, the relative frequency and mean intensity of Duchenne display and the relative frequency of Duchenne laughter for each of the 16 enjoyable emotions were computed by averaging across all interview scenarios for that emotion. Furthermore, an index was created based on the rating study by dividing the likelihood of occurrence of laughter by the likelihood of occurrence of joy. This index was applied and helped identifying five laughter-eliciting enjoyable emotions, namely *schadenfreude* (1.25), relief (0.95), amusement (0.94), wonder (0.87) and tactile sensory pleasure (0.86). These were kept separate in some analyses from the no laughter-eliciting emotions, such as contentment (0.63), olfactory (0.65) or elevation (0.67).

Results

Overall 817 Duchenne displays were coded; this was 52.4 % of the maximally possible responses. The rate of responses was higher among those with no gelotophobia (68.3 %) than among the gelotophobia group (36.4 %). Participants showed a Duchenne display from between a minimum of 2 and a maximum of 37 out of 39 times over all of the individual scenarios of the 16-PEIT and between a minimum of 2 and a maximum of 16 times for the enjoyable emotions. Every person smiled to at least one of the scenarios. In fact, in the no gelotophobia group, the occurrence of the Duchenne display ranged between a

minimum of 7 times and a maximum of 16 times with a median of 14 times. For the gelotophobia group the Duchenne display rate ranged between 2 and 16 with a median of 10 and only one gelotophobic participant responded to all 16 emotions with a Duchenne display.

Once a Duchenne display was shown it typically was of average intensity ($M = 3.16$; $SD = 1.01$). The averaged intensity of Duchenne display for the 16 enjoyable emotions ranged from $M = 2.75$ ($SD = 0.53$) for elevation to $M = 3.77$ ($SD = 0.61$) for relief. The rank order of the mean frequency of Duchenne display (from highest to lowest) to the enjoyable emotions were: *schadenfreude*, contentment, excitement, auditory, relief, amusement, wonder, ecstasy, gustatory, elevation, tactile, visual, gratitude, *naches*, olfactory and *fiero*. The emotion of tactile, gustatory and olfactory sensory pleasures as well as *naches* all yielded the highest possible intensity of Duchenne display. Thus, providing evidence that the interview technique was suitable at eliciting Duchenne displays.

Laughter was expressed 60 times; this was 3.8 % of all possible responses. Of the 9 people laughing 7 were from the no gelotophobia group (and they produced 51 laugh acts) and two from the gelotophobia group (producing 9 laugh acts). In the no gelotophobia group the enjoyable emotions going along with laughter most frequently were *schadenfreude* (12.5 %), relief (13.3 %), tactile (10.0 %), and amusement (7.5 %) whereas *fiero*, contentment, olfactory had no participants laughing.

A 2 × 16 repeated measure ANOVA with level of gelotophobia (no gelotophobia vs. gelotophobia) as a grouping variable and the 16 pleasurable emotions on the repeated measurement factor was performed for mean intensity of the Duchenne display. The main effect for level of gelotophobia was significant, $F\ (1,\ 38) = 26.70$, $p < .001$, $\eta_p^2 = .413$, and so was the interaction, F (9.05, 343.96) = 2.09, $p < .01$, $\eta_p^2 = .052$ (Greenhouse-Geisser corrected). The emotion profiles of the no gelotophobia and gelotophobia groups are given in Fig. 1.

Pair-wise comparisons between the no gelotophobia and gelotophobia groups for each of the 16 pleasurable emotions showed that the gelotophobia group yielded a lower mean intensity than the no gelotophobia participants ($p < .05$; alpha adjusted) in *schadenfreude*, relief, amusement, tactile pleasure, and wonder. Thus, while the main group effect was highly significant, there were enjoyable emotions where the gelotophobia and no gelotophobia groups did not differ in the present sample.

Separate 2 × 2 repeated measure ANOVAs with level of gelotophobia as grouping variable (no gelotophobia, gelotophobia) and type of enjoyable emotion (no laughter-eliciting, laughter-eliciting) on the repeated measurement factor was performed for frequency and intensity of the Duchenne display. We did compute the score for relative

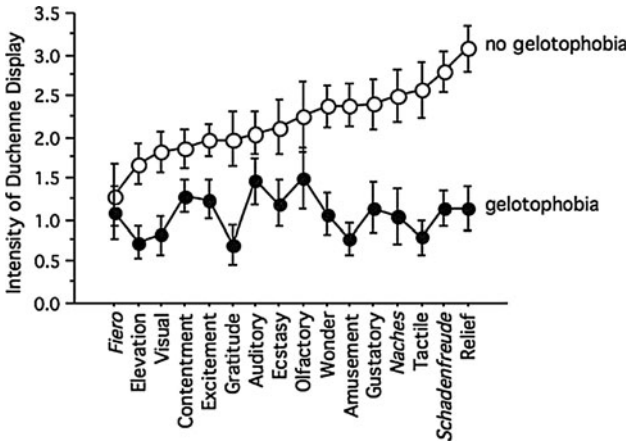

Fig. 1 Intensity of Duchenne display during 16 pleasurable emotions (sorted for intensity in the no gelotophobia group) for individuals with no fear and fear of being laughed at

frequency by first averaging the number of displays for each enjoyable emotion and then averaging across the laughter-eliciting and no laughter-eliciting emotion separately. Furthermore, we did derive a pure measure of intensity (that is not contaminated by frequency) by averaging the intensity scores for those scenarios where the individual showed a response. Then we averaged these intensities across the emotions (separated for laughter related an non laughter related) again for those emotions where a response was shown. This way frequency of responses did not enter the definition of intensity; i.e., it is the average intensity for those events where a response occurred.

For relative frequency of the Duchenne display, the main effect for gelotophobia was significant, $F\ (1,\ 38) = 26.99$, $p < .001$, $\eta_p^2 = .415$, and so was the interaction, $F\ (1,\ 38) = 9.18$, $p < .01$, $\eta_p^2 = .195$. Post hoc tests were computed to compare the no and laughter-eliciting enjoyable emotions among each other for the two groups separately. The means are given in Fig. 2.

Post hoc tests were performed to analyze the nature of the interaction. Figure 2 shows that while the gelotophobia group displayed positive emotions with a higher frequency compared to the no gelotophobia group ($p < .001$), this effect was stronger for the laughter-eliciting positive emotions ($p < .001$, $\eta_p^2 = .489$) than for the no laughter-eliciting positive emotions ($p < .001$, $\eta_p^2 = .368$). The latter, however, still yielded a very strong effect size. Furthermore, as expected, the no gelotophobia group showed Duchenne display significantly more often for the laughter-eliciting emotions than for no laughter-eliciting emotions ($p < .01$; $\eta_p^2 = .453$). However, the frequency of Duchenne display did not differ between laughter and no laughter-eliciting emotions among the gelotophobia group.

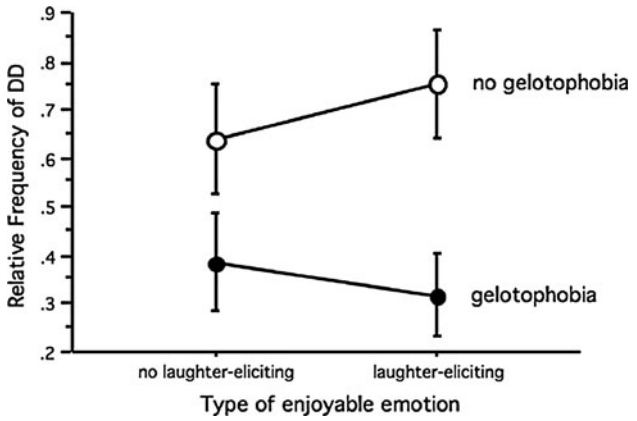

Fig. 2 Relative frequency of Duchenne display (DD) during laughter-eliciting and no laughter-eliciting enjoyable emotions separately for individuals with no gelotophobia and with gelotophobia

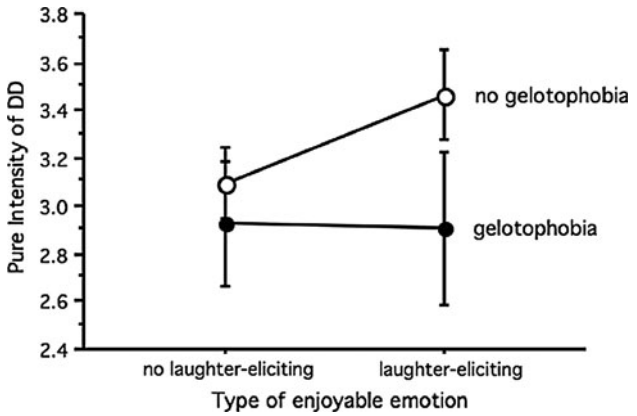

Fig. 3 Pure intensity of Duchenne display (DD) during laughter-eliciting and no laughter-eliciting enjoyable emotions separately for individuals with no gelotophobia and with gelotophobia

For the (pure) intensity of the Duchenne displays the main effect for gelotophobia was significant, F (1, 37) = 6.36, $p < .05$, $\eta_p^2 = .147$, and so was the interaction, F (1, 37) = 7.30, $p < .01$, $\eta_p^2 = .165$. The means and standard deviations are given in Fig. 3.

Figure 3 shows that as expected in the no gelotophobia group the intensity of Duchenne display was significantly higher for the laughter-eliciting emotions than the no laughter-eliciting emotions ($p < .01$; $\eta_p^2 = .417$). The intensity of Duchenne display did not differ between laughter and no laughter-eliciting emotions among the gelotophobia group. Furthermore, the no gelotophobes and gelotophobes did not differ significantly with respect to the intensity of display for the no laughter-eliciting positive emotions ($p = .44$), but the former were significantly higher in intensity for the laughter-eliciting positive emotions ($p < .01$, $\eta_p^2 = .212$).

As for gelotophobes the laughter-eliciting positive emotions were not less frequent or less intense than the non-laughter-eliciting positive emotions, the analyses were rerun distinguishing between slight gelotophobia ($n = 8$) and marked/extreme gelotophobia ($n = 12$). This analysis yielded a clear effect for frequency. For the slight gelotophobia group no effect was found ($p = .49$, and the scores actually increased) but the marked gelotophobia group showed significantly less facial enjoyment during the laughter-related enjoyable emotions than during the no laughter-eliciting positive emotions ($p < .01$, $\eta_p^2 = .441$). However, no such effect was found for the intensity scores. Thus, gelotophobes tend to have a reduced inclination to facially respond to laughter-eliciting enjoyable emotions (compared to no laughter-eliciting enjoyable emotions), but if they responded with a Duchenne display it was of comparable intensity. Likewise, the lack of difference between individuals with no gelotophobia and gelotophobia for the no laughter inducing pleasurable emotions was examined further by distinguishing between slight and marked gelotophobia, as the strengths of the effect might increase with the level of gelotophobia. Indeed, the main effect was significant ($p < .05$, $\eta_p^2 = .169$); individuals with a marked fear of being laughed at were lower than both the ones with slight and no fear ($p < .05$).

Finally, pre-post changes in cheerful mood and positive affect (PA) were investigated for the three groups of non gelotophobes, slight and marked gelotophobes separately. The main effect for time of measurement for state cheerfulness, F (1, 19) = 26.66, $p < .001$, $\eta_p^2 = .584$ and PA, F (1, 19) = 11.08, $p < .01$, $\eta_p^2 = .368$ was significant for the non gelotophobes, as they increased in PA and state cheerfulness. For slight fear of being laughed at an increase was found for cheerfulness, F (1, 7) = 12.95, $p < .01$ $\eta_p^2 = .649$ but not for PA, F (1, 7) = 0.81, $p = .398$. However, for the ones with pronounced fear of being laughed at no pre-post differences were found for cheerfulness, F (1, 11) = 1.24, $p = .290$, and PA, F (1, 11) = 2.91, $p = .116$.

Discussion

The present study extends the findings of prior studies (Platt 2008; Platt and Ruch 2009), in two significant ways. These papers indicated that gelotophobes have low intensity of joy in self-reported measures. Utilizing the FACS, this study set out to see if the self-reported lower intensity of joy was actually observable in the facial expressions of joy, the Duchenne display. Overall Hypothesis 1 was confirmed: gelotophobes showed less facial expression of joy than those without gelotophobia. The main effect for gelotophobia typically yielded a partial eta square of at least .40, which is a very strong effect. This was true for

both the overall score as well as the intensity and frequency components of responses.

Furthermore, this hypothesis was also tested for subgroups. Non-gelotophobes constantly exceeded gelotophobes also when aggregated to the two types of enjoyable emotions. The post hoc tests revealed that they differ in respect to laughter-eliciting enjoyable emotions and to no laughter-eliciting enjoyable emotions, both in terms of frequency and intensity (the latter only for people with the marked gelotophobia). Finally, at the least aggregate level they also differ for the single enjoyable emotions, namely *schadenfreude*, relief, amusement, tactile pleasure and wonder; i.e., the enjoyable emotions that are more prone to elicit laughter.

However, one can not state that they differ for all enjoyable emotions, as there was no effect for certain single enjoyable emotions, such as *fiero* or contentment. This needs explanation. We can speculate that there is no difference for these 11 enjoyable emotions; for example, as these are ones that people enjoy in solitude and where no laughter of others is possible. However, it is also possible that there were too few scenarios per enjoyable emotion to produce reliable differences. Also, maybe the scenarios were not strong enough. A further explanation could be that the hypothesis only works for those individuals with a marked presence of gelotophobia and that slight gelotophobia is not triggering these effects. It has to be noted, however, that some effects already reliably appear for slight gelotophobia (Platt 2008; Platt and Ruch 2009). One might also argue, that due to the measurement error within the gelotophobia assessment some slight gelotophobes are actually borderline and just exceeded the cut-off point due to measurement error. However, this is unlikely as we verified their gelotophobia status in two measurement points four weeks apart. Thus, the hypothesis can be verified in all tests except the level of selected individual positive emotions. Apart from clinical vignettes described by Titze (2009) this is the first empirical evidence that gelotophobes do differ from non-gelotophobes in facial expression of joy.

The investigation provided mixed support for second hypothesis. While all the interactions were significant, not each of post hoc tests confirmed the predictions. As predicted, there was a stronger difference between gelotophobes and non-gelotophobes for the laughter-eliciting enjoyable emotions than for the no laughter-eliciting enjoyable emotions. Looking at gelotophobes and non-gelotophobes separately one could see that those with no gelotophobia responded more frequently to the laughter-eliciting enjoyable emotions (than to the no laugher eliciting enjoyable emotion), and when they did, they also did respond with higher intensity. Moreover, they showed an increase in state cheerfulness and positive affect post compared to before the experiment. However, the reverse was not always found. While those with gelotophobia, more precisely those with a marked fear, indeed showed less frequently a Duchenne display in response to the laughter-eliciting emotions (compared to the no laughter-eliciting enjoyable emotion) they did not show a lower intensity. It is worth mentioning that the marked gelotophobes had an average intensity of about 2.7 (i.e., only slightly less than the broad average intensity category of AU12C) to both groups of positive emotions; i.e., they already start out low and a decline might be hard to observe unless one uses facial electromyography that allows for a more fine grained differentiation of intensity. Again one might argue that the low number of scenarios per emotion did not form a reliable average, or that the laughter element was not so apparent and did not apply to each of the scenarios of a category. However, it might also be that gelotophobes just do not respond to laughter-eliciting emotions with a joyful expression but when they do it is of the same intensity as to the no laughter eliciting emotion. Also, a future test of the hypotheses might need a separate study of individuals with extreme fear of being laughed. As for now, it is safe to concluded that gelotophobes do not increase their intensity of facial expression to joy as the non gelotophobes do and this is also paralleled in the fact that their positive affect or level of state cheerfulness did not differ. While the study by Ruch et al. (2009) showed that gelotophobes have problems with the correct decoding of laughter, the present study seems to suggest that encoding and sending smiling and laughter is affected as well. Right now it cannot be said whether gelotophobes are also reduced in the expression of emotions other than joy or what facial expression they do display when a Duchenne display is expected.

As was found previously (Papousek et al. 2009; Ruch et al. 2009), in the present study the induction of enjoyable emotions did not lead to an increase of positive mood in the gelotophobes. Neither state cheerfulness nor the more global positive affect was higher after gelotophobes imagined joy during the 39 scenarios. The non-gelotophobes profited from this exposure to positive emotions and showed elevated mood after indulging in a variety of enjoyable emotions. Thus, gelotophobes do not only have difficulties perceiving the positivity in stimuli and generate joy at higher intensity themselves; they also do not absorb the positive affect inherent in hedonic stimuli. It is doubtful that for gelotophobes positive emotions "broaden and build". Fredrickson (1998; Fredrickson and Branigan 2001) offered the theory claiming that positive emotions have the ability to "[…] broaden people's momentary thought-action repertoires and build their enduring personal resources" (2001, p. 219). This not only includes building of enduring personal, but also physical, intellectual, social, as well as psychological

resources. Interventions fostering positive emotions will have to consider the existence of gelotophobia and take into account not only that for some individuals positive emotions do not do much, but also that laughter-eliciting positive emotions might have an aversive effect.

There are several limitations to this study. First, it is unclear whether imagining an enjoyable event of a particular kind is a good marker for each of the 16 enjoyable emotions alike. The scenarios made sense to the participants and they most often remembered a highly similar event to the one described. While elaborating on their feelings it was apparent that they were currently reliving the emotion, and as only those parts of the discourse were coded where participants seemed to be immersed in this experience the chance to get a facial expression representing the respective facet of joy was maximized. Nevertheless, one might argue that it might be easier to remember or imagine a situation of gratitude or contentment, than to generate (high levels of) excitement and ecstasy or to actually imagine sensory pleasures. While obviously participants did not report problems doing so, one might argue that the enjoyable emotion induced by this method is not proportional to the emotion as induced by a genuine elicitor of that emotion (e.g., actually currently eating a delicious meal or feeling grass tickling one's skin). Thus, so far the results are restricted in their validity to imagining, remembering and talking about enjoyable emotions.

A further almost inevitable limitation lies in the choice of the emotions selected. While we chose a very comprehensive list one can still argue that some pleasant emotions are missing. We already highlighted before that other proposals of positive emotions (Shiota et al. 2006; Fredrickson and Branigan 2001) partly use other pleasant emotions. There are other to consider, such as tenderness and eroticism (Bloch et al. 1991; Kalawski 2010).

The present study did not do a content analysis of all verbal utterances to verify the nature of the enjoyable emotion. Also no self-rating of intensity was undertaken at the end of each scenario which would have provided another index for estimating the degree of joy in the different facets. This was done to keep the interview more informal.

Another limitation is that the number of scenarios for each of the 16 categories was rather low. This was to prevent boredom and habituation. This might have resulted in two problems, both of which might have prevented to see the decline in joy for the laughter-eliciting emotions (compared to the no laughter-eliciting scenarios). First, due to the low number of scenarios, to average across the propensity to each enjoyable emotion, means is not measured reliably. Second, despite the fact that joy was rated in the pre-study the level of joy was not comparable across the 16 enjoyable emotions; this might have impaired the comparison among the different enjoyable emotions. Thus, once the number of laughter relevant enjoyable emotions is known, a selected smaller list of enjoyable emotions with and without (but with more scenarios) laughter should be compared. More scenarios, or more generally, elicitors might be used and this would allow for a final test of the hypothesis. For now, as the interaction was significant one can clearly say that the fear of being laughed at interacts with the nature of joy, with no versus laughter-eliciting indeed being the crucial variable.

Acknowledgments This article was written thanks to the support of the research grant 100014_126967 given to Willibald Ruch and René T. Proyer by the Swiss National Science Foundation. The authors would like to thank Fabian Gander and Tobias Wyss for their valuable contribution to the data collection. We would also like to acknowledge the work of the Zurich Interaction and Expression Lab team for their help processing the video materials.

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